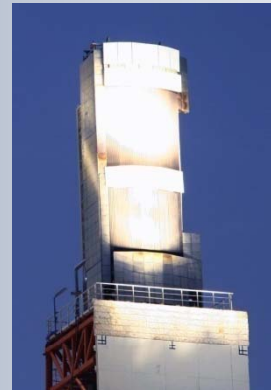




## BrightSource Energy & Ivanpah Project Overview for the Renewable Energy Policy Group



January 22, 2010

# Presentation Outline

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➤ Corporate Overview

➤ Technology (R&D)

➤ Development

➤ Ivanpah

➤ Environment



# BrightSource Energy Snapshot

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**Mission:** BrightSource Energy's mission is to make solar energy cost competitive with fossil fuels by developing, building, owning and operating the world's most cost-effective and reliable large-scale solar energy projects.

➤ **Business:**

- Develop and build large-scale solar power generation plants for utilities at prices that compete with fossil-fuel plants, using proprietary technology
- Develop and build solar-to-steam plants for industrial applications

➤ **Financial Strength:**

- Over \$160M in corporate financing from key strategic investors including: VantagePoint Venture Partners, Morgan Stanley, Google.org, BP Alternative Energy, StatoilHydro Ventures, Chevron Technology Ventures, Black River, Draper Fisher Jurvetson, and DBL Investors (a spin-off from JP Morgan), and others

➤ **Team:**

- Includes all of the key senior managers of Luz International, which designed and built more than 350 MW of solar thermal plants built in the 1980's
- World class project development team with over 20GW of power projects developed, constructed, and managed

➤ **Locations:**

- Headquarters in Oakland, California, 52 full-time employees
- Subsidiary BrightSource Industries (Israel) located in Jerusalem, 115 full-time employees



# BrightSource Energy Highlights

## Proven Technology:

- SEDC generating highest temperature and pressure solar steam in the world
- 14 months of operations and independent engineering firm evaluations



## Largest Development Pipeline in Industry:

- 2.6GWs of signed PPAs with PG&E, SCE
- Shortlisted for projects in Israel and Australia

## Projects Under Development:

- **Chevron Solar to Steam for EOR**



- **Ivanpah 400MW Electric for PG&E and SCE**

- ❖ Bechtel as EPC and Investor
- ❖ Siemens as Turbine Supplier
- ❖ DOE loan guarantee
- ❖ ITC cash grant eligible



SIEMENS



## 20 Years Ago Luz Int'l Revolutionized the Solar Energy...

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**354 MW of Solar Thermal – Built in '80s and '90s & Operating Today**

***1990s Policy Failures Stalled Progress for Decades***



# Concentrated Solar Power Advantages

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- Produces power when needed the most, at peak
- Provides firm dispatchable output, avoiding volatility associated with other intermittent resources
- Uses less land than other large-scale renewable resources
- Storage- and hybrid- capable, to smooth output and reduce need for conventional unit commitment and dispatch
- Enhances integration; provides reliability services of turbine-generated power and power qualities familiar to utilities & grid operators
- Stable, known and decreasing costs



**BrightSourceEnergy™**



# BrightSource Solution – LPT 550

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- Proven Technology
- Direct Solar-to-Steam
- Higher Temp. – 550° C
- Low Parasitic Load
- Higher Operating Efficiency
- Lower Capital Cost
- Uses Commodity Materials:
  - Flat Glass
  - Minimum Concrete
  - Minimum Steel
- Air-Cooled Power Block  
& Closed-Loop Water Recycling
- Zero Liquid Discharge

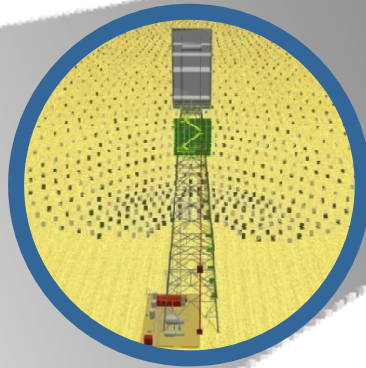




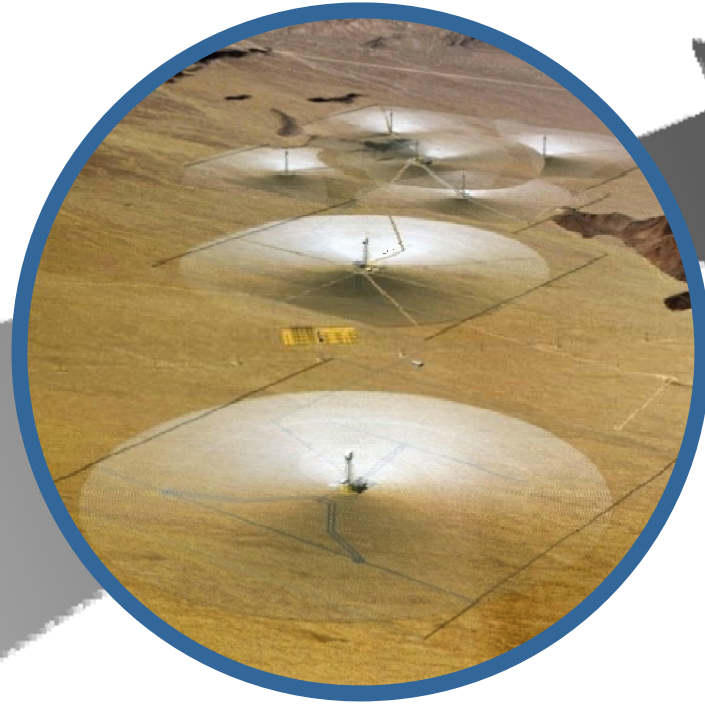
# Project Scale - Up



**Solar Energy  
Development  
Center**  
2Q/2008  
(6 MWth)



**Solar Thermal  
Chevron EOR  
Demo Plant**  
4Q/2010  
(29 MWth)



**Ivanpah Solar  
Power Complex**  
1Q/2012  
(400 MWe)

# Projects: Solar Energy Development Center

## Key Design Parameters

6 MWth production capacity

60 meter receiver tower

1,640 heliostats

12,000 meters of reflecting area

Commissioned: June 2008

Clean, Reliable and Low Cost Solar Energy



## Key Demonstration Accomplishments

World's highest temperature and pressure solar thermal steam production known to be achieved

Independent verification by RW Beck

18 months of operations; excellent performance

Optimization of mirror synchronization



# Chevron EOR Demonstration Plant

- 29 MWth
- Construction started June 2009
- Heat exchanger for injection water
- 3,750 LH-2 Heliostats (14 m<sup>2</sup>)
  - Lower temperature
  - Lower Pressure
  - Closed loop boiler water feed





# Ivanpah Solar Energy Generating System

## Ivanpah Milestones

PG&E and SCE PPAs in place

Negotiating final terms for US DOE Loan Guarantee

Bechtel Selected as EPC contractor; equity owner in all three projects

123MW Siemens turbine purchased

CEC and BLM permitting anticipated mid-2010

1st Plant COD scheduled mid-2012

Existing Transmission Corridor Bisects Site, Providing Access

## World-class Partners



**SIEMENS**



# Ivanpah Economic Benefits



## Economic Benefits

State and Local Tax Revenues: \$400 million\*

1,000 construction jobs at peak; four million work hours

86 permanent jobs

Total employee earnings: \$650 million\*

\*30 year plant life-cycle

# Ivanpah Environmental Benefits



## Environmental Benefits

CO<sub>2</sub> Emissions avoided: 13.5 million tons total over lifecycle; 450,000 tons per year

Water use: 100 acre feet per year – 25 times less than competing technologies

Air Pollutants Reductions: 85% less than natural-gas fired plants

Low impact design requires less grading; no extensive concrete pads in solar field

Zero Liquids Discharge



# BrightSource's Environmental Commitment

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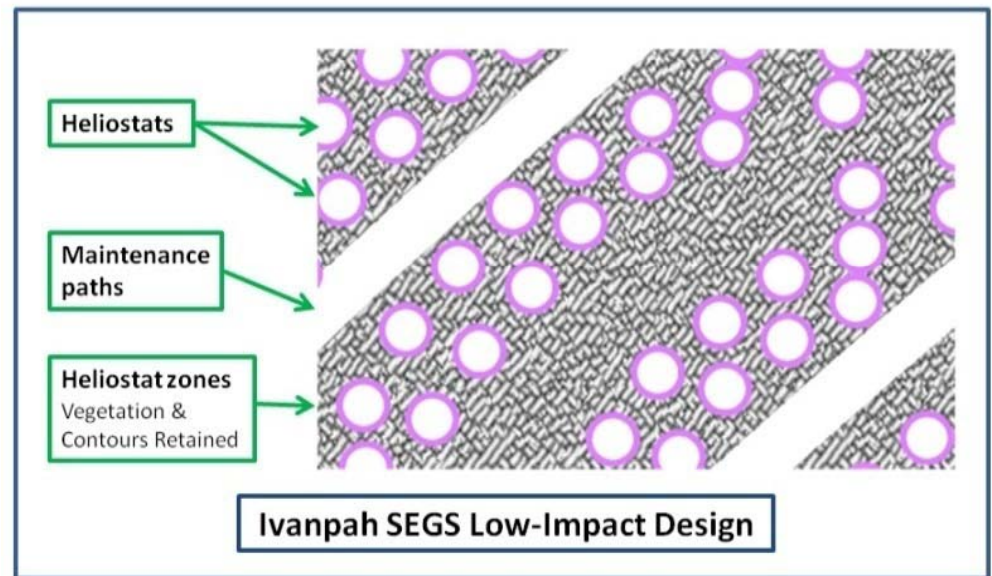
## ➤ Site Selection:

- The site does not contain any Areas of Critical Environmental Concern (ACECs), Desert Wildlife Management Areas (DWMAs) or other designated Critical Habitat
- It is bisected by a major high-voltage transmission corridor, and is currently used for cattle grazing, off-road vehicle use, and other activities
- The site is adjacent to a 36-hole golf course and a second major high-voltage and natural gas transmission corridor, near a major interstate highway and less than five miles from casinos and outlet centers
- There are no state or federal endangered species on the site; there is a low density of a single threatened species, the desert tortoise
- The site is ranked by BLM as the lowest management category for desert tortoise, Category 3, considered “least important” for recovery of the species
- BLM requires site restoration at closure; mitigation should contribute to overall recovery of species in the face of climate change

# BrightSource's Environmental Commitment

## ➤ Plant Design:

- Maximizes retention of existing vegetation, land contours & natural features
- Solar field does not require leveling or large quantities of concrete
  - Mirrors placed individually on pylons, without need for foundations
  - Vegetation in the solar field heliostat zones trimmed to allow mirrors to track the sun, but otherwise left in place
  - Soils and vegetation disturbed during construction to be restored

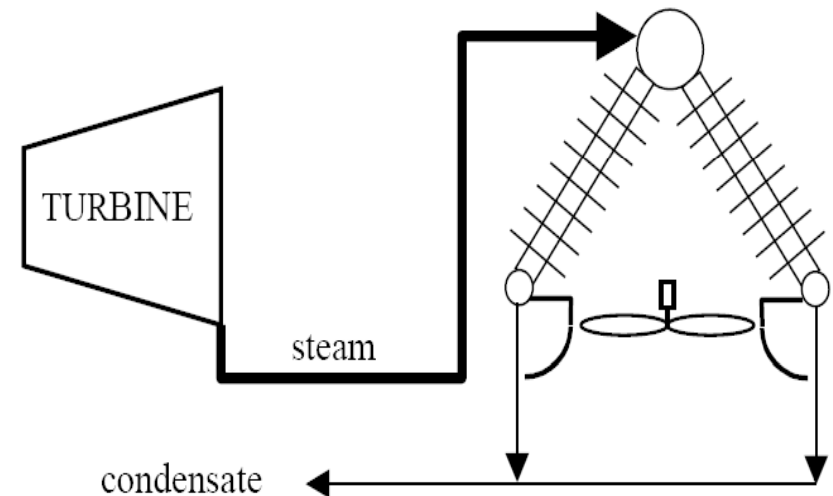


# BrightSource's Environmental Commitment

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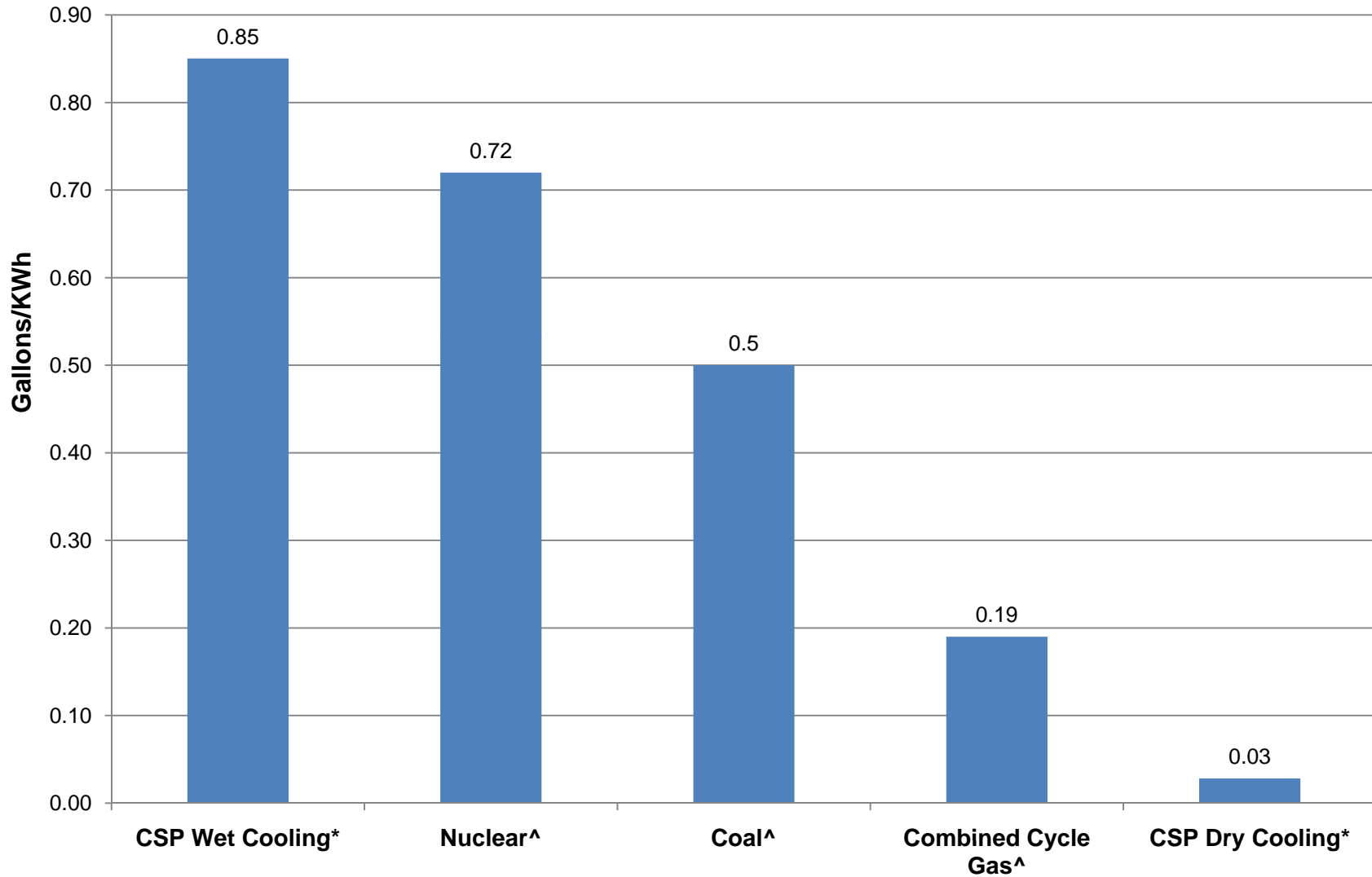
## ➤ Water Use: Dry-cooling, Conservation & Closed-loop recycling

- Uses air instead of water to condense steam
- 90% reduction in water use for this project
- 100 acre feet per year – equal to 300 homes worth of water
- Closed-loop recycling & conservation measures further reduce usage
- Efficiency trade-off; additional costs
- Ivanpah will use 25 times less water than competing technologies





# Wet CSP/Conventional Cooling vs. Dry CSP Cooling



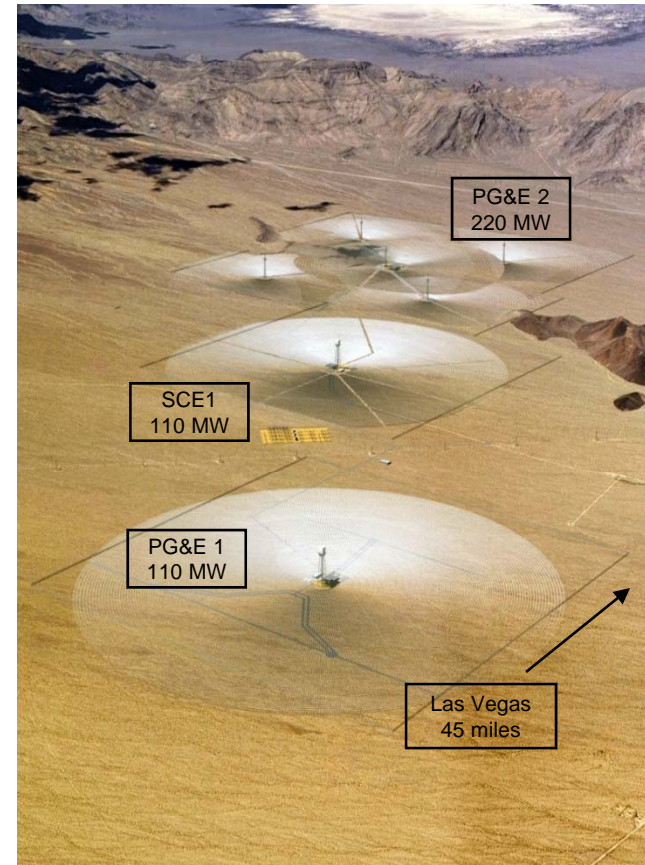
\*Source: California Energy Commission

^Source: Nuclear, Coal and Combined Cycle numbers from World Economic Forum report - Thirsty Energy: Water and Energy in the 21st Century

# BrightSource Ivanpah Solar Energy Complex

- ❑ Proven, high-performance and high-efficiency technology
- ❑ Promotes California's RPS and AB32 with both PG&E and SCE PPAs
- ❑ Promotes 2005 Energy Policy Act, Executive & Secretarial Orders
- ❑ Promotes ARRA & DOE Stimulus and Innovative Technology goals
- ❑ Avoids 450,000 tons of CO<sub>2</sub> annually; 13.5 million tons total over lifecycle
- ❑ Dry-cooling and other measures keeps water usage to 100 acre-ft/yr
- ❑ Provides 1000 jobs at peak; 4 million work hours overall

## Ivanpah Facility Schematic



A photograph of a solar field in a desert. Several large, rectangular solar collectors are visible, arranged in a row that recedes into the distance. The collectors are tilted at an angle, reflecting the bright blue sky and some clouds. The ground is dry, sandy soil. The sky is a deep blue with some light, wispy clouds. The overall scene is bright and sunny, with a strong lens flare effect visible in the bottom left corner of the image.

**BrightSourceEnergy™**

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